

ROCKY FLATS PLANT, PLUTONIUM RECOVERY
FACILITY
(Building 371)
NW portion of the Rocky Flats Plant
Golden vicinity
Jefferson County
Colorado

HAER No. CO-83-K

HAER
COLO
30-GOLD.V
1K-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
1849 C St. NW
Washington, DC 20240

HISTORIC AMERICAN ENGINEERING RECORD

ROCKY FLATS PLANT, PLUTONIUM RECOVERY FACILITY (Rocky Flats Plant, Building 371)

HAER No. CO-83-K

HAER
COLO
30-GOLDV
1K-

Location: Rocky Flats Environmental Technology Site, Highway 93, Golden, Jefferson County, Colorado. Building 371 is located in the northwestern portion of the Rocky Flats Plant (Plant).

Date of Construction: 1981.

Fabricator: Frank Briscoe.

Present Owner: United States Department of Energy (USDOE).

Present Use: Plutonium Recovery.

Significance: This building is a primary contributor to the Rocky Flats Plant historic district, associated with the United States (U.S.) strategy of nuclear military deterrence during the Cold War, a strategy considered of major importance in preventing Soviet nuclear attack. Building 371 was originally built to replace plutonium recovery operations in Buildings 771 and 776, using advanced technology for plutonium handling, recovery, and safety. The design was far more sophisticated and complex than any others at the Plant. It was designed to emphasize automatically controlled, remotely operated processes, in contrast to the direct, hands-on operations in Building 771. Building 371 was designed in 1968 and construction was completed in 1981, but the design did not meet new safeguard and security requirements implemented in 1976. The plutonium recovery process never ran at full capacity, and after 1983, the recovery operations ceased altogether.

Historians: D. Jayne Aaron, Environmental Designer, engineering-environmental Management, Inc. (e²M), 1997. Judith Berryman, Ph.D., Archaeologist, e²M, 1997.

Project Information:

In 1995, an inventory and evaluation was conducted of facilities at the Rocky Flats Plant for their potential eligibility for listing in the National Register of Historic Places. The primary goal of this investigation was to determine the significance of the Cold War era facilities at the Plant in order to assess potential effects of the long-term goals and objectives of the USDOE. These goals and objectives have not yet been formalized, but include waste cleanup and demolition

activities. Recommendations regarding National Register of Historic Places eligibility were developed to allow the USDOE to submit a formal determination of significance to the Colorado State Historic Preservation Officer for review and concurrence and to provide for management of historic properties at the Plant.

From this determination and negotiations with the Colorado State Historic Preservation Officer, the Advisory Council, and the National Park Service, a Historic American Engineering Record project began in 1997 to document the Plant's resources prior to their demolition. The Plant was listed on the National Register of Historic Places in 1997. The archives for the Historic American Engineering Record project are located in the Library of Congress in Washington, D.C.

Introduction:

The Plant is one of thirteen USDOE facilities that constitute the Nuclear Weapons Complex, which designed, manufactured, tested, and maintained weapons for the U.S. arsenal. The Plant was established in 1951 to manufacture triggers for use in nuclear weapons and to purify plutonium recovered from retired weapons. The trigger consisted of a first-stage fission bomb that set off a second-stage fusion reaction in a hydrogen bomb. Parts were formed from plutonium, uranium, beryllium, stainless steel, and other materials.

A tense political atmosphere both at home and abroad during the Cold War years drove U.S. weapons research and development. By the 1970s, both the U.S. and the Soviet Union maintained thousands of nuclear weapons aimed at each other. These weapons were based on submarines, aircraft, and intercontinental ballistic missiles. Both the North Atlantic Treaty Organization and Warsaw Pact countries in Europe had small nuclear warheads known as theater weapons used as part of the Mutually Assured Destruction program. (The Mutually Assured Destruction program acted as a deterrent in that if one side attacked with nuclear weapons, the other would retaliate and both sides would perish.) The final nuclear weapons program at the Plant was the W-88 nuclear warhead for the Trident II missile. This mission ended in 1992 when President Bush canceled production of the Trident II missile.

The Plant was a top-secret weapons production plant, and employees worked with a recently man-made substance, plutonium, about which little was known concerning its chemistry, interactions with other materials, and shelf life. The Historic American Engineering Record documentation effort focused on four aspects of the Plant and its role in the Nuclear Weapons Complex: manufacturing operations, research and development, health and safety of workers, and security.

Chronology of Building 371:

ROCKY FLATS PLANT, PLUTONIUM RECOVERY FACILITY
HAER No. CO-83-K
(Page 3)

- 1968 The decision was made to replace the Building 771/774 Plutonium Recovery Facility with the Building 371/374 complex.
- 1970 The construction plan for Building 371 was authorized.
- 1973 Site preparation, groundbreaking, and fencing for building construction began.
- 1976 The building was originally scheduled for start-up, however, construction was temporarily halted due to problems with the construction contractor.
- 1978 Waste treatment operations began in Building 374.
- 1980 Waste treatment in Building 374 began handling non-radioactive wastes from Building 371. The wastes were generated from start-up testing operations of non-radioactive solutions.
- 1981 Construction of Building 371 was completed. USDOE authorized radioactive operations. Plutonium pyrochemical recovery operations (molten salt extraction) began on a limited basis. The first electrorefining run in the tilt-pour furnace began.
- 1982 Pilot-scale aqueous plutonium operations began, including recovery in March, primary purification in April. Initial full-scale operations of the aqueous recovery system began in August.
- 1983 The Plant produced the first plutonium metal processed entirely through the building's aqueous recovery system. The Plutonium Recovery Modification Project was established as a result of plutonium inventory accountability problems during pilot-scale operations in the aqueous recovery process. Its purpose was to identify processing deficiencies in Building 371 and to design replacement processes. Aqueous recovery operations ceased in April.
- 1985 The site contractor submitted the Conceptual Design Report to USDOE detailing modifications needed to bring Building 371 into full operation.
- 1986 Electrorefining activities ceased. Approximately half of the processes that were originally operating in the building had been shut down by this date. The last major recovery operations terminated.
- 1988 Pyrochemical processing ceased.

ROCKY FLATS PLANT, PLUTONIUM RECOVERY FACILITY
HAER No. CO-83-K
(Page 4)

1990 Funding for replacement plutonium recovery processes for Building 371 was denied by Congress.

Building History:

Building 371 was originally built to replace plutonium recovery operations in Buildings 771 and 776, using advanced technology for plutonium handling, recovery, and safety. Although fundamentally based on the processes and principles developed previously in Building 771, the design of Building 371 incorporated many technological advances and refinements. The design was far more sophisticated and complex than any others at the Plant. Building 371 was designed to emphasize automatically controlled, remotely operated processes, in contrast to the direct, hands-on operations in Building 771. The projected operations for the building focused primarily on recovery of plutonium from both solid and liquid wastes. The final product from the process operations was intended to be recycled plutonium metal, which was to be reused in the Plant's primary manufacturing process.

Building 371 was originally scheduled to be completed in 1976 and to cost approximately \$70 million. The stacker-retriever, a remotely operated, mechanized transport system to move plutonium storage drums, became operational in 1976. In 1980, the heating, venting, and air-conditioning systems were brought on-line and start-up testing operations using non-radioactive solutions began. The rest of the building was finally completed in 1981 for a total cost of approximately \$214 million. Limited pyrochemical plutonium recovery operations began in 1981.

In 1982, pilot-scale aqueous plutonium recovery operations began in Building 371. There were not enough operators to run the process continuously, so the process was run in batches, shutting down one phase to start the next. Employees were to be transferred to the new facility when it was fully operational and Building 771 was shut down.

One year after the aqueous recovery process began, the USDOE conducted an inventory of the plutonium at the Plant, and the Building 371 inventory was found to be deficient. The building had more than 770 miles of piping, of which 70 miles were plutonium processing lines. Process lines ran through walls and traversed several floors. In the 1960s, plutonium inventories were calculated by the amount of material that went into the process and the amount that came out; the amount residing in the process was estimated. By 1976, accountability was required for every gram of material at all times; estimating the amount of plutonium residing in the process was no longer acceptable. The aqueous process was shut down until all in-process plutonium could be located. The majority of the material was found. Designed in 1968, Building 371 was not constructed to meet this type of safeguard and security requirement. Although several projects to upgrade the system were proposed, none were approved. The process never ran at full capacity nor did the process ever again become operational after 1983.

Building Description:

Building 371 was designed to emphasize the use of automatically controlled, remotely operated processes. Design features included the use of remotely operated transfer systems for movement of radioactive materials. The stacker-retriever, a computer-operated, rail-mounted shuttle moved radioactive material between storage and plutonium recovery operations.

The plutonium handling areas of the building are compartmentalized by fire walls, airlocks, and the use of negative air pressure to prevent the spread of plutonium from one area to another. The compartments are further divided into rooms, canyons, and vaults. Rooms were used to house glove box operations and equipment that did not require special containment precautions. Canyons were used to house plutonium handling operations that were not contained within glove boxes. Process equipment within the canyon was remotely operated; the canyon and all the equipment inside were contaminated with plutonium.

Vaults are essentially storage areas that are designed to prevent criticality of stored plutonium-containing materials. To prevent nuclear criticality, storage racks hold containers in a safe geometry, and tanks and containers within the vaults are of a safe geometry, or are filled with boron-glass Raschig rings. Tanks in certain areas are located behind 2' concrete walls, which helped to shield personnel from radiation in the unlikely event of a nuclear criticality.

Building Layout

Building 371 is a four-level partially buried structure constructed of reinforced concrete. It encompasses approximately 186,000 square feet of floor space. The building construction was hardened to withstand the forces imposed by a design-basis earthquake or tornado. The hardened construction includes the exterior walls and roof, those parts of the building where plutonium recovery operations were conducted, and portions of the building that housed equipment or systems essential to the recovery processes or were required to contain plutonium within the building.

The sub-basement, the bottom level, is an irregularly shaped area, consisting primarily of the lower portion of the plutonium storage vault and its transfer, repair, and the stacker-retriever maintenance bays. Areas at the east end contain the lower parts of the glove box scrubbers, the incinerator vent scrubber, and the filtration process area, plus utility equipment for the sub-basement. The sub-basement measures 364' (east to west) x 180' (north to south).

The east end of the sub-basement contains a stacker-retriever transfer bay, Room 1220; a repair bay, Room 1218; a maintenance bay, Room 1216; a preventative maintenance bay, Room 1224; and three airlocks (Rooms 1214, 1222, and 1230). These provided space and equipment to service the stacker-retriever and to house a spare stacker-retriever. Glove boxes in the preventative maintenance bay allowed access for repairs to stacker-retriever electronic systems. The sub-basement has hardened walls and a nitrogen atmosphere. The repair bay can be entered

ROCKY FLATS PLANT, PLUTONIUM RECOVERY FACILITY
HAER No. CO-83-K
(Page 6)

through an airlock, but before entering, the bay must be closed off and the nitrogen atmosphere must be replaced with breathable air. This allowed personnel access to make repairs to the mechanical systems of the stacker-retriever.

Extending from the sub-basement upward to the ground floor level, is Room 1206, the plutonium storage vault. The vault, which provided temporary storage for plutonium compounds, is a long narrow chamber with approximate dimensions of 300' x 15' x 40'. Vault walls are 14' thick concrete. The vault has an array of 1,428 metal storage bins attached to the full length and height of the side walls, with a single open aisle down the center. Each bin holds a 4' x 4' metal pallet, which has cylindrical holders for plutonium storage containers. For criticality safety, the cylindrical holders are at predetermined locations, and the storage containers are double-walled and water-filled. To access the containers, the stacker-retriever is mounted on rails that run the length of the aisle between the two rows of bins. At one end of the vault, the rails end in a large transfer bay that connects to the repair and preventative maintenance bays.

The basement houses heating, venting, and air conditioning equipment and mechanical utilities, the upper part of the plutonium storage vault and maintenance bay, and small plutonium processing areas. The basement level is divided into nearly equal north and south parts by the upper portion of the plutonium storage vault. The basement is 330' (east to west) x 250' (north to south); it extends to the south nearly 70' under the ground floor of the office areas in the southern portion of the building. In the northeast section, Room 2327, is a portion of the incinerator vent scrubber canyon; Rooms 2325 and 2321 are the dissolution process area and control room. The upper parts of two glove box ventilation scrubbers are in the basement, one on the north side and one on the south side.

The ground floor contained the majority of the plutonium recovery processes, and office space. The office space, located along the southern length of the building, is segregated from the plutonium handling areas of the building by hardened construction.

The plutonium processing areas of the ground floor are divided by hallways into six compartments. The compartments are constructed of noncombustible materials, and have at least a two-hour fire rating to prevent the spread of fire, and to limit potential contamination from a fire to a single area. Each of the compartments is further subdivided into modules or rooms, and within the modules or rooms, the plutonium processing equipment is contained in glove boxes, canyons, or vaults. The purpose of these enclosures within enclosures was to contain particulate radioactive material and shield operating personnel from radiation.

The northwest compartment contains equipment for aqueous and pyrochemical plutonium recovery processes. This compartment is divided into two modules (north and south). The north module is further divided into two canyons, one vault, and nine other rooms. The south module is further divided into four rooms.

ROCKY FLATS PLANT, PLUTONIUM RECOVERY FACILITY
HAER No. CO-83-K
(Page 7)

The southwest compartment is divided into two vaults, a control room, and an area for processing site returns. Site returns were nuclear weapons returned to the site for upgrade or retirement.

The north central compartment contains equipment for aqueous recovery operations, and storage areas for plutonium oxides and residues from the aqueous recovery operations. This compartment is divided into two modules (north and south), and three other rooms. The north module is further divided into two vaults, two canyons, and twelve other rooms. The south module is further divided into four canyons, and nine other rooms.

The south-central compartment is divided into thirteen rooms which included analytical and standards laboratories, the health sciences group, decontamination areas, heater rooms, and a backlog barrel storage area.

The northeast compartment is divided into three canyons, and four other rooms. Two of the canyons house incinerators; the third canyon houses a scrubber system for the incinerators. The rooms house residue loading and unloading operations, and control operations for the canyons.

The southeast compartment is divided into two rooms. The southeast compartment was used for shipping and receiving of plutonium and plutonium-containing materials, and a high-bay drum storage area for residues with high levels of radioactivity.

The attic, level four, provides protected space for air distribution systems, chemical piping, electrical conduit, and two motor-generator sets.

Transfer systems

Building 371 is equipped with two systems for the transfer of radioactive materials. The pneumatic transfer system was used to transfer materials of moderate to low radioactivity. The vacuum transfer system was used to transport highly radioactive materials.

Pneumatic Transfer System

The pneumatic transfer system consists of twenty-four transfer lines of two sizes and uses pneumatic pressure to move materials. The smaller line is 1" x 3" (inner dimension), is made of polyethylene, and was used to transfer liquid and solid samples. The larger line is 3" x 12" (inner dimension), is made of polycarbonate, and was used to transport used filters. The pneumatic transfer system was used to transfer materials between the basement and ground floors.

Vacuum Transfer System

The vacuum transfer system consists of thirty-one lines, and uses differential pressure to move highly radioactive materials. Two of the lines also use argon and nitrogen pressure as well as vacuum as the motive force. These two lines need the additional force to keep the material in a

fluidized state during transfer. The vacuum transfer system was used to transfer materials between the sub-basement, basement, and ground floors.

A typical bulk vacuum transfer system consists of a hand-held pick-up wand, pick-up vessel (or slop pot), conveyor tube (0.75"- or 1.5"-diameter welded stainless steel), cyclone separator, filters, material receiver, and process vessel. The system also has high- and low-level sensors, valves, switches, and indicator lights, all interlocked and tied into local control sequence panels.

Incinerators

There are two incinerators and their afterburners, in separate concrete canyons, that were used for burning wastes: one in Room 3713 for high specific activity waste, and the other in Room 3715 for low specific activity waste. Due to the size and shape of the incinerators, they span multiple levels (basement to attic). Feed material entered the incinerators at ground floor level.

The high specific activity waste incinerator is an oil-fired, refractory-brick-lined, rotary kiln that can burn both liquid and solid line-generated waste from plutonium processing buildings. The revolving cylinder is horizontal, but it can be adjusted through a series of angles from the horizontal to control the rate of material flow. Ash and residue from the high specific activity incinerator was further processed for plutonium recovery.

The low specific activity incinerator is an oil-fired, raked-hearth, stationary, vertical furnace lined with refractory brick. It has forced-air-cooled rabble arms rotating on a central vertical shaft. The arms swept material across a stationary hearth plate during burning. Ash and residue from the low specific activity incinerator were packaged for disposal.

The plutonium recovery facility, Building 371, is one of five buildings that comprise the Plutonium Recovery and Waste Treatment complex. The other buildings in the complex are Building 372, a guard post; Building 373, a cooling tower; Building 374, a waste treatment facility; and Building 381, fluorine gas storage. Utility lines, roads, drainage control structures, and fencing also constitute part of the total complex.

Building Operations:

Operations in Building 371 focused on the recovery of plutonium from Plant activities (nuclear weapons parts fabrication, component assembly, and research and development activities). Americium, a decay by-product of plutonium, was separated from plutonium and recovered for resale. Other operations included material transfer, waste incineration, and laboratory support.

Plutonium Recovery

Plutonium recovery operations used two different systems to separate high-purity plutonium metal from production-generated wastes. Pyrochemical processing used furnaces and molten salts to separate high-purity plutonium in a dry process. Pyrochemical processing was efficient,

but could not be used in all situations. Aqueous processing used a series of wet and dry chemical steps to separate high-purity plutonium from production generated wastes.

Materials entering the plutonium recovery process were received as pieces of impure plutonium metal, plutonium oxide, various compounds containing plutonium, and plutonium-contaminated residues. The plutonium content of these materials ranged from a few percent to almost pure plutonium metal. The plutonium and americium content of the residues was reduced by the recovery processes to a level below the economic discard limit.

Pyrochemical Plutonium Recovery

Metal plutonium was processed through a pyrochemical operation in which americium was extracted from plutonium by direct contact with molten salts, yielding a plutonium button low in americium. If other impurities had to be removed, the extracted metal went to an electrorefining process where the plutonium was transformed by electrolysis in a molten-salt bath, resulting in an impure plutonium heel, contaminated salt, and product metal of very high purity. Impure metal was burned, converting it to an oxide, and processed through the aqueous chemical recovery systems. The high-purity plutonium button was transferred to the Building 707 foundry operations for casting and weapon component fabrication. Contaminated salts were transferred to Building 771 for americium separation and plutonium recovery.

Aqueous Plutonium Recovery

Plutonium oxide and other materials required a series of wet and dry chemical processing steps to produce a plutonium button of high purity. As a first step, the oxide and other materials were dissolved in nitric acid in a series of cascade dissolution pots. The plutonium-containing acid solutions from the dissolution process were blended into a nitric acid feed which was pumped through anion-exchange resin columns. The anion-exchange resin selectively absorbed plutonium ions while allowing certain other metallic ions to pass through. Americium formed a weak bond with the resin, allowing selective segregation of some americium from the plutonium-rich stream. Solutions high in americium were segregated for further processing in americium recovery, and the remainder went through a secondary recovery process.

The anion-exchange eluate was concentrated in an evaporator. The evaporator concentrate fed into a line of precipitation vessels where the plutonium was precipitated as plutonium peroxide. The precipitate was filtered and the filtrate recycled through anion exchange. The precipitate was transferred to a calcining furnace where the plutonium peroxide was converted to plutonium oxide by heating.

The dry plutonium oxide was pneumatically transported to a fluidized-bed reactor in the direct fluorination canyon (Room 3523). The plutonium oxide was contacted with a fluorine-argon gas mixture to keep it fluidized while converting it to plutonium tetrafluoride. When the reaction was complete, the plutonium tetrafluoride was transported to a receiving chamber in the reduction canyon (Room 3515).

Calcium metal was measured into reduction vessels, and the plutonium tetrafluoride was added. The reduction vessel was sealed in an induction furnace and heated to initiate a reduction reaction that yielded a pure plutonium metal button and calcium fluoride slag. The plutonium button was sampled, stamped, and shipped as product. The calcium fluoride slag was recycled as cascade dissolver feed.

A process line was installed in the building to recover americium from solutions isolated during the anion exchange loading steps. Although the system was never fully operational, it was designed to operate as follows. The solutions were to be alternately evaporated and diluted to reduce the nitric acid concentration. Then, sets of anion and cation exchange columns, operated in series, were to be used to purify the concentrated americium solution. Next, oxalic acid was to be added to the concentrate to precipitate americium oxalate. The precipitate was collected in a filter boat and calcined to convert it to americium dioxide. Americium was a saleable product used in medical diagnostic tracer procedures, in ionization-type smoke detectors, and in static eliminators.

Laboratories

Building 371 housed plutonium analytical laboratories and a chemical standards laboratory, which supported operations throughout the Plant. The plutonium analytical laboratories served Buildings 371 and 374, and acted as backup for the Building 771 analytical laboratory. The majority of the work at this laboratory consisted of total alpha and beta counts along with radiochemical analyses for specific isotopes in liquid and solid samples. These analyses served as a screen to identify highly radioactive samples which were unsuitable for detailed analysis in Building 881.

The chemical standards laboratory prepared both non-destructive assay and destructive assay standards for various user groups at the Plant and inspected standards used in the field. Most laboratory operations took place in glove boxes. Non-destructive assay standards were prepared for plutonium, americium, and uranium oxides and metals (including beryllium) for a wide range of instrumentation.

Incinerators

The low specific activity waste incinerator burned all combustible waste generated outside glove boxes or hoods from plutonium process buildings throughout the Plant. Solid waste was burned to reduce volume. The resulting ash was packaged for disposal.

The high specific activity waste incinerator burned waste generated within glove boxes and hoods from plutonium processing buildings. Both solid and liquid wastes were burned. The resulting ashes were analyzed by radiometric counting methods for plutonium content, classified, and subjected to appropriate plutonium recovery processes.

ROCKY FLATS PLANT, PLUTONIUM RECOVERY FACILITY

HAER No. CO-83-K

(Page 11)

Pneumatic Transfer System

The pneumatic transfer system transferred process filters from glove boxes associated with metal and glass leaching, pyrochemical salt dissolution, and dissolution filtration processes to the high specific activity incinerator glove box. Process material samples (liquid and solid) were transferred from process glove boxes to laboratory glove boxes for analysis.

Before transfer, contaminated filters and samples were containerized, filters were sealed in plastic bags, and samples (liquid or solid) were placed in bottles with screw-on caps. The bagged filter or the bottled sample was placed inside a carrier, which also had a screw-on cap, providing double containment for the material. The closed carrier was then placed in the loader-receiver and sent to the opposite end of the pneumatic system. When the loader-receiver arrived, the door was opened, the carrier removed and opened, and the bagged filter or the bottled sample taken out.

Vacuum Transfer System

The vacuum transfer system transported highly radioactive materials between recovery processes, from the plutonium storage vault to recovery processes, and to and from shipping and receiving areas. The bulk liquid or solid was pulled into the transfer pipes and moved using the pressure differential created by the vacuum pumps. These radioactive materials were transferred in measured batches. Before a transfer was made, the operator ensured there was adequate space in the receiving vessel, and that the receiving vessel discharge valve was closed.

When bulk transfer conveyor tubes passed outside glove boxes or canyons, secondary containment was provided by enclosing the conveyor tubes within welded stainless steel pipes. The stainless steel pipes had ports for contamination monitoring. Gas-tight barriers at intervals along the pipes separated the secondary containment space at one end of the system from that at the other end.

Stacker-Retriever

Storage and retrieval of plutonium metal and solid residues was accomplished by using the stacker-retriever. The stacker-retriever moved materials between the shipping and receiving areas, the plutonium storage vault, and the plutonium recovery processing areas.

Operations Since 1989:

Since operations ceased at the Plant in 1989, operations in Building 371 have focused on waste and special nuclear material handling and storage and on laboratory operations.

Sources: Buffer, Patricia. 1995. "Highlights in Rocky Flats History". Rocky Flats Repository. Golden, Colorado.

- Colorado Department of Health. *Project Tasks 3 & 4 Final Draft Report. Reconstruction of Historical Rocky Flats Operations and Identification of Release Points (1992)*, by ChemRisk. Rocky Flats Repository. Golden, Colorado.
- Crisler, L. R. 1991. "Rocky Flats Plant Plutonium Recovery Reference Process." for EG&G Rocky Flats, Inc. Rocky Flats Repository. Golden, Colorado.
- Daggy, David, employed at the Plant since 1981 by the site contractor. Personal communication, September 1997.
- United States Department of Energy. *Building Histories - Historical Release Report (1994)*, by EG&G Rocky Flats, Inc. Rocky Flats Plant Repository. Golden, Colorado, 1994.
- United States Department of Energy. *Final Site Safety Analysis Report - Building 371*, Rocky Flats Plant Repository. Golden, Colorado, 1989.
- United States Department of Energy. *Final Cultural Resources Survey Report (1995)*, by Science Applications International Corporation. Rocky Flats Repository. Golden, Colorado, 1995.
- Weaver, Jack, employed at the Plant since September of 1961 by the site contractor. Personal communication, August 1997 and February 1998.